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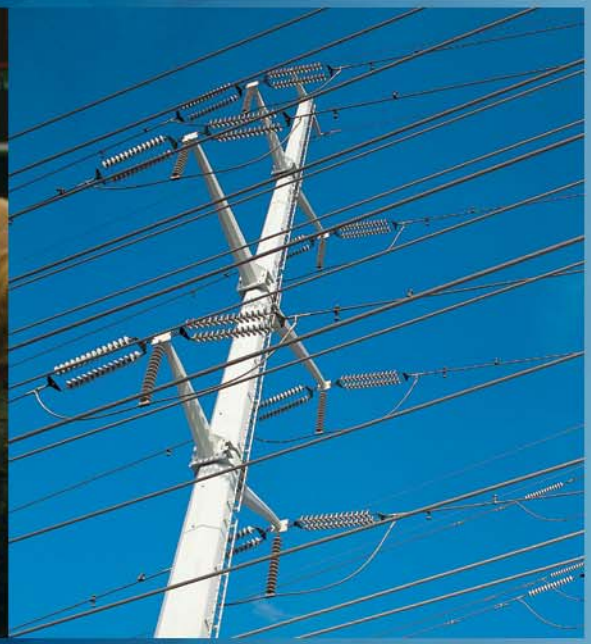
Twelve Times Ramp in Price Setting

April 26, 2006



Twelve Times Ramp

- Introduction
- How do we set price now?
- What other options are there to use for price?
- Options outside price
- Decision Criteria
- Stakeholder input to date
- Presentation by APPrO
- IESO thoughts to date
- Round Table Discussion
- Wrap up – next steps

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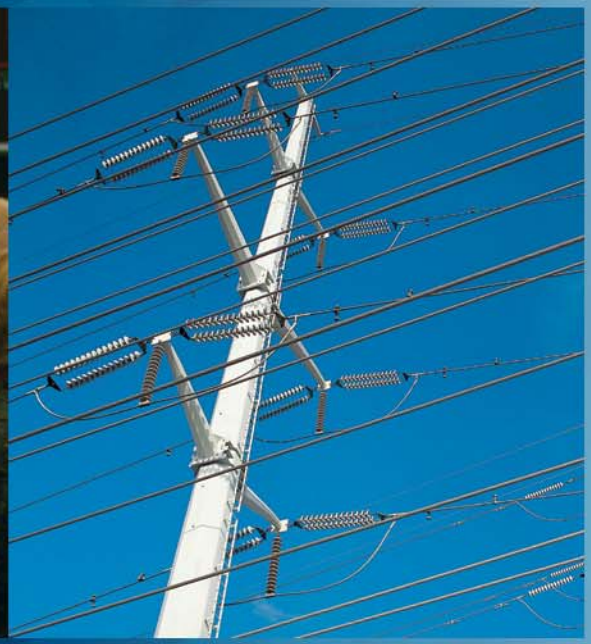
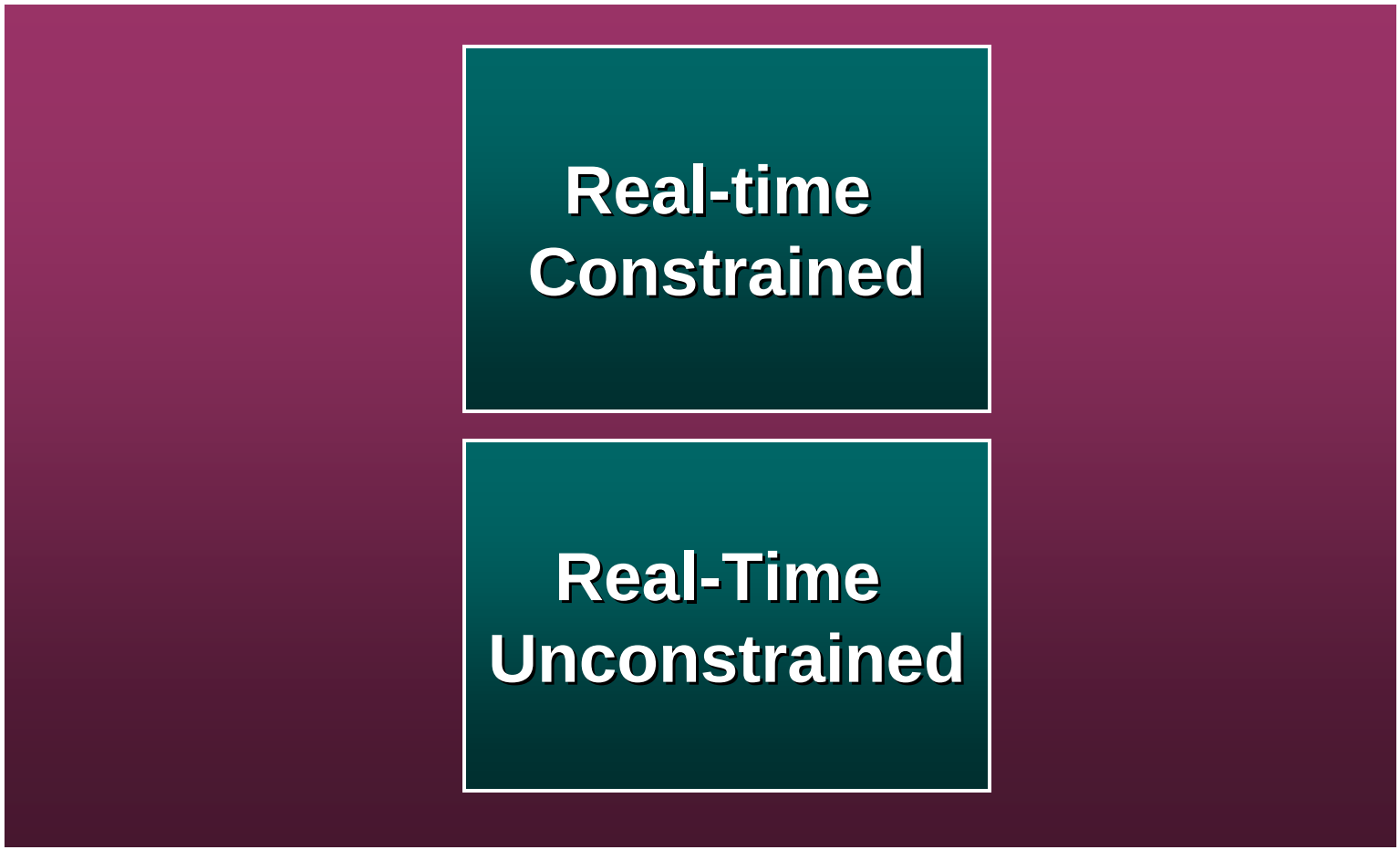
Determining Market Price and Dispatch



The Dispatch Algorithm



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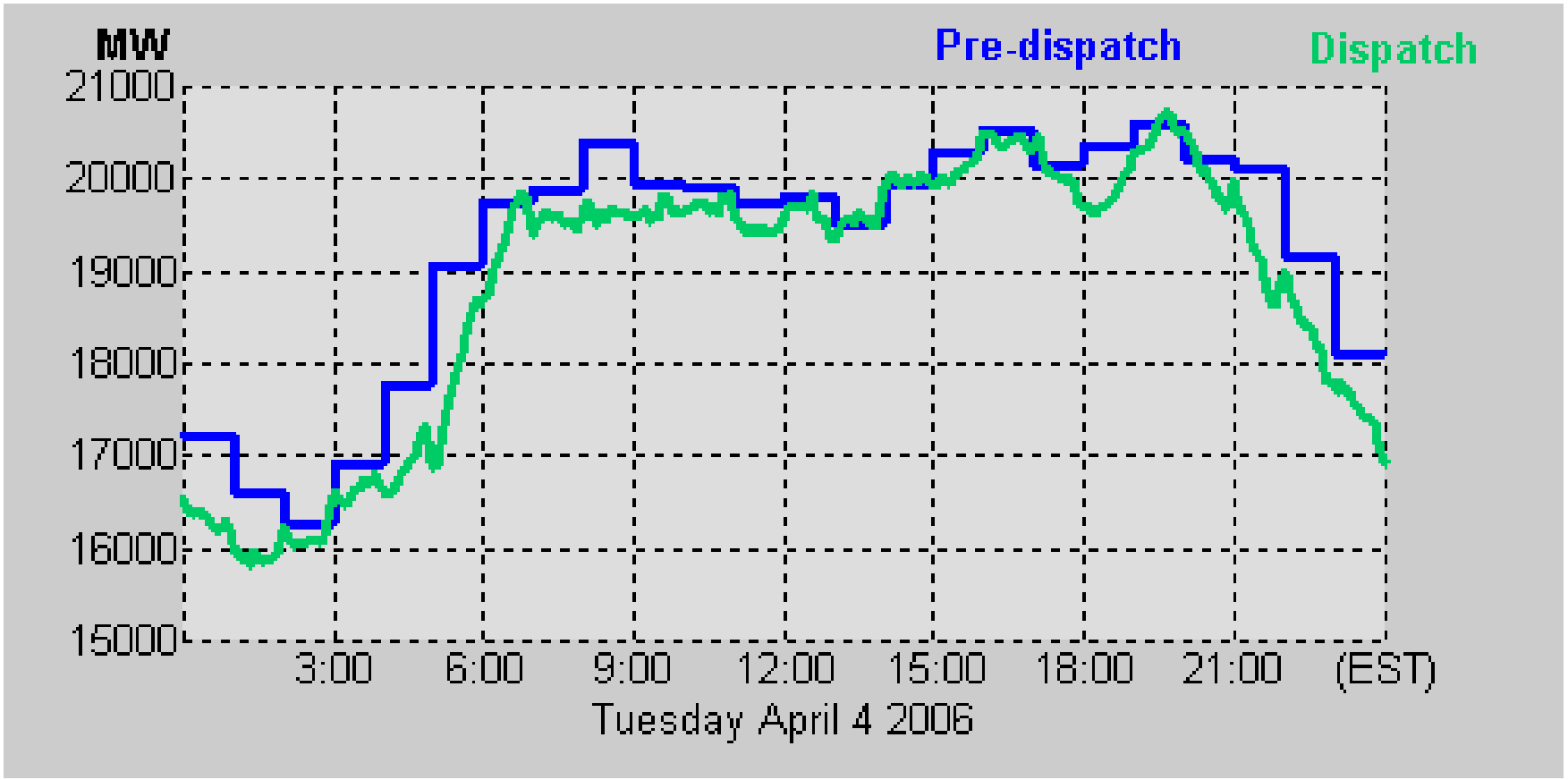
MW
Pre-dispatch
Dispatch
21000
20000
19000
18000
17000
16000
15000
3:00
6:00
9:00
12:00
15:00
18:00
21:00
(EST)
Tuesday April 4 2006

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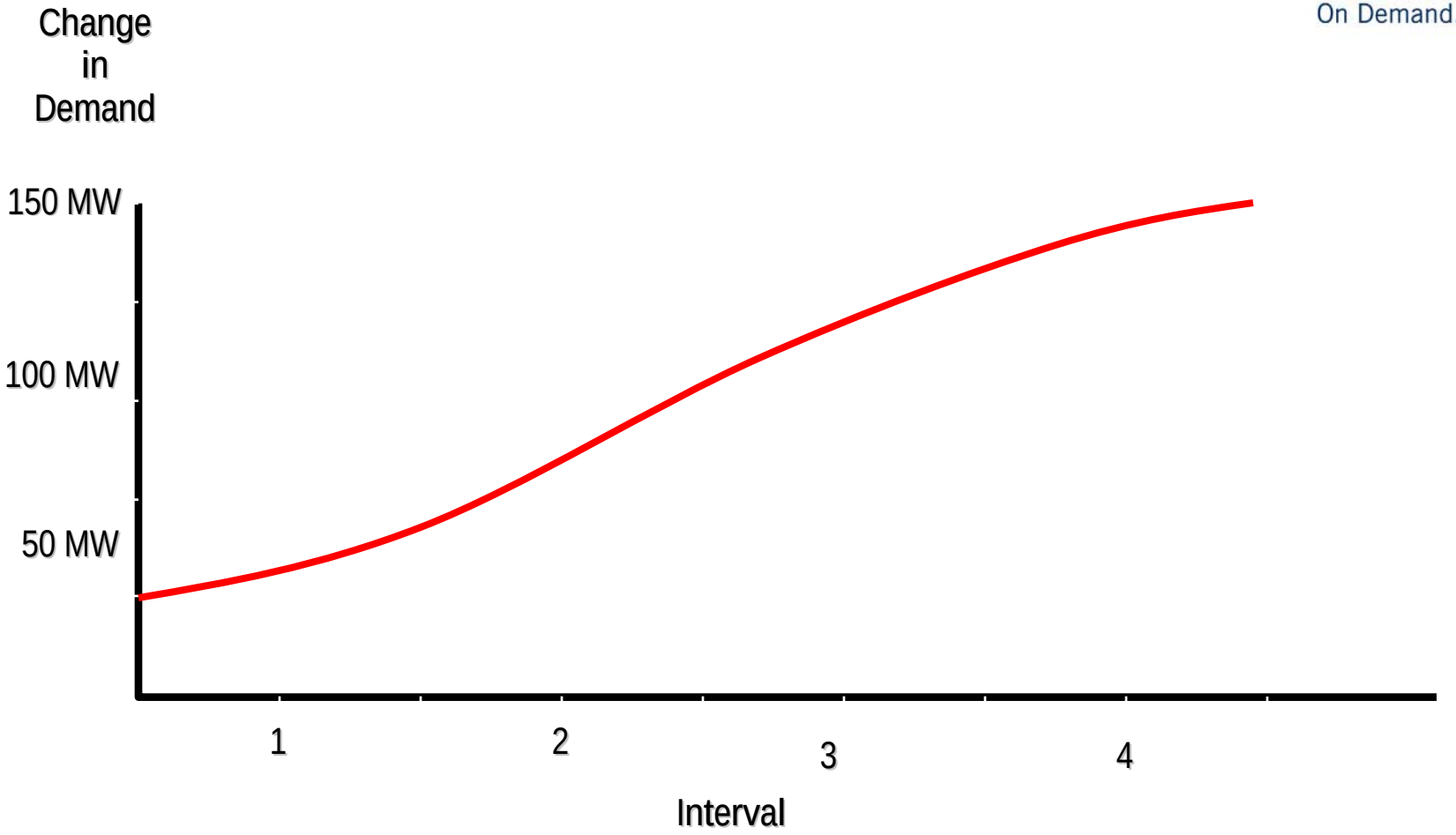
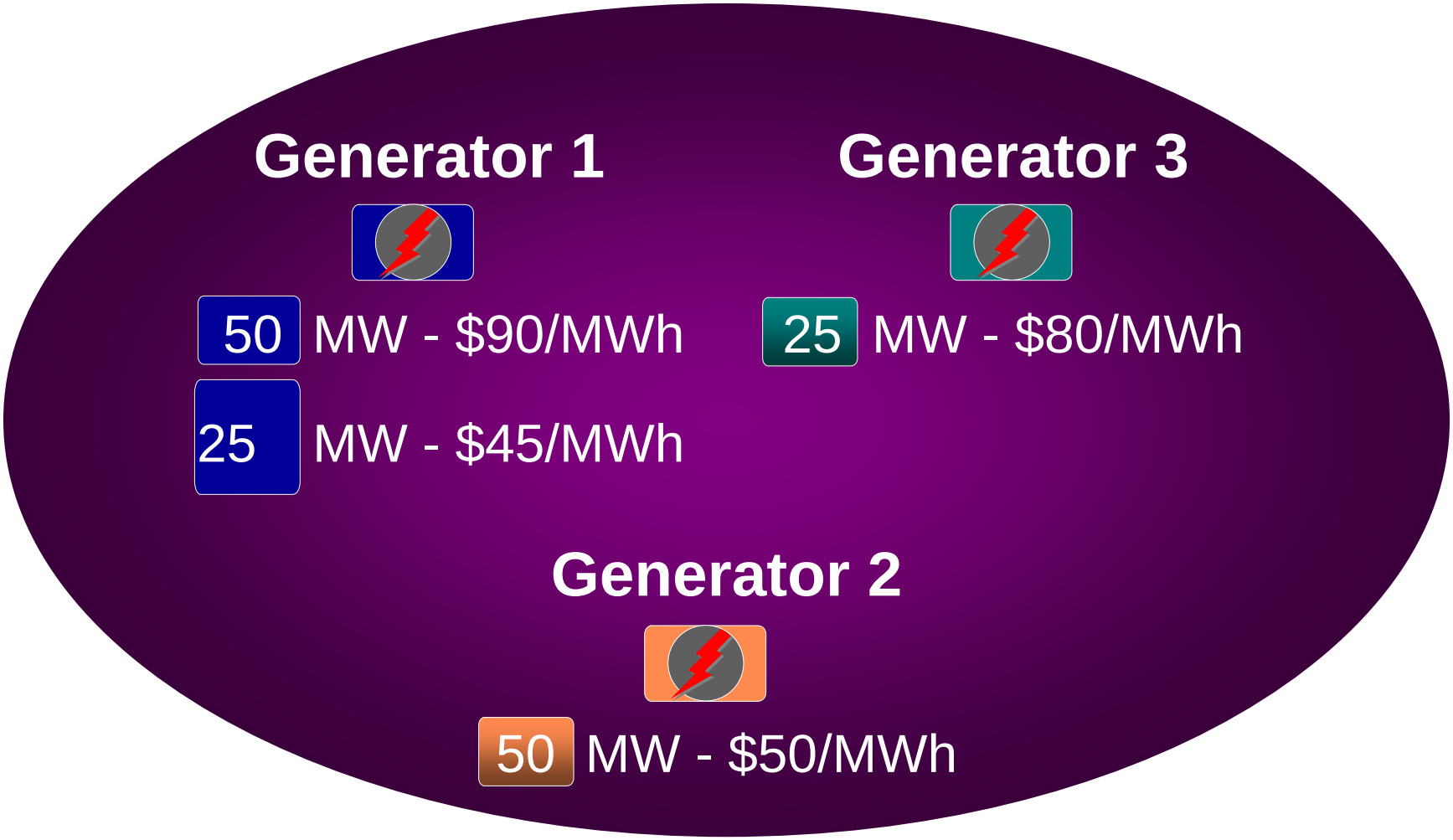
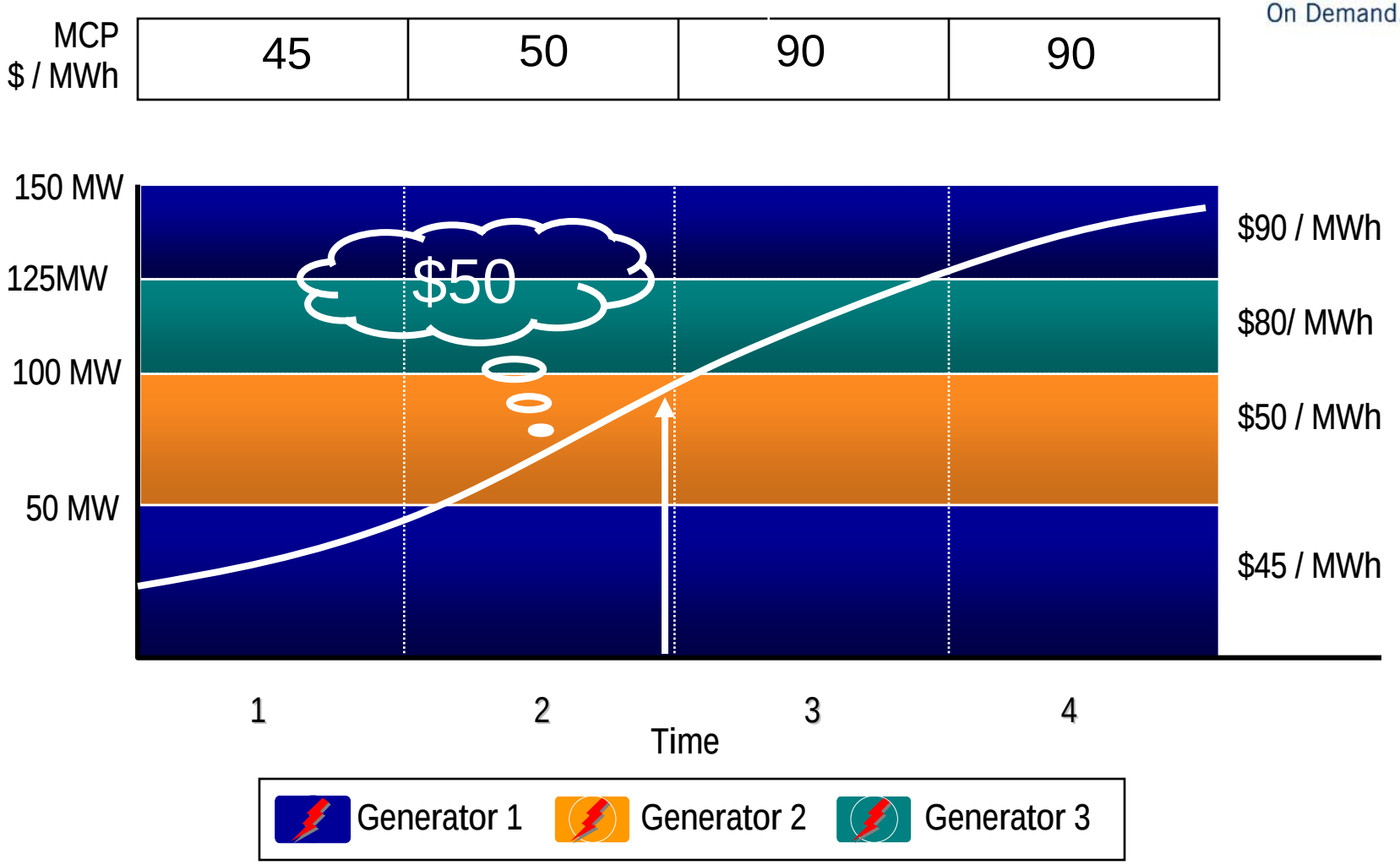


Setting the Market Clearing Price – An Example



Offers Are Stacked Economically



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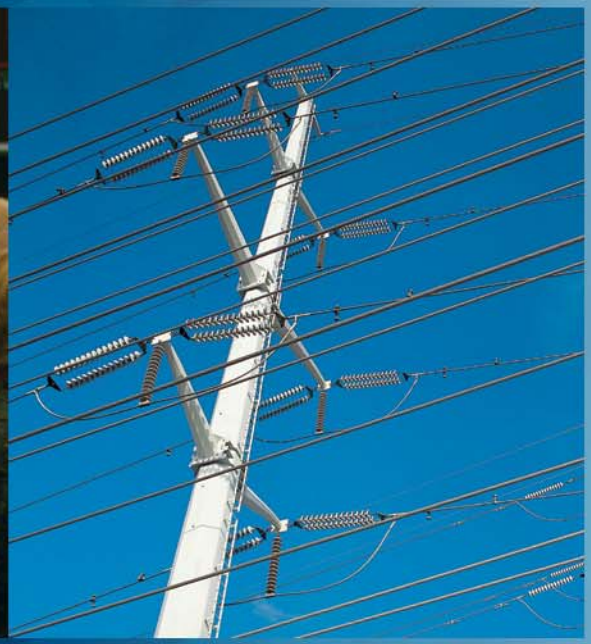
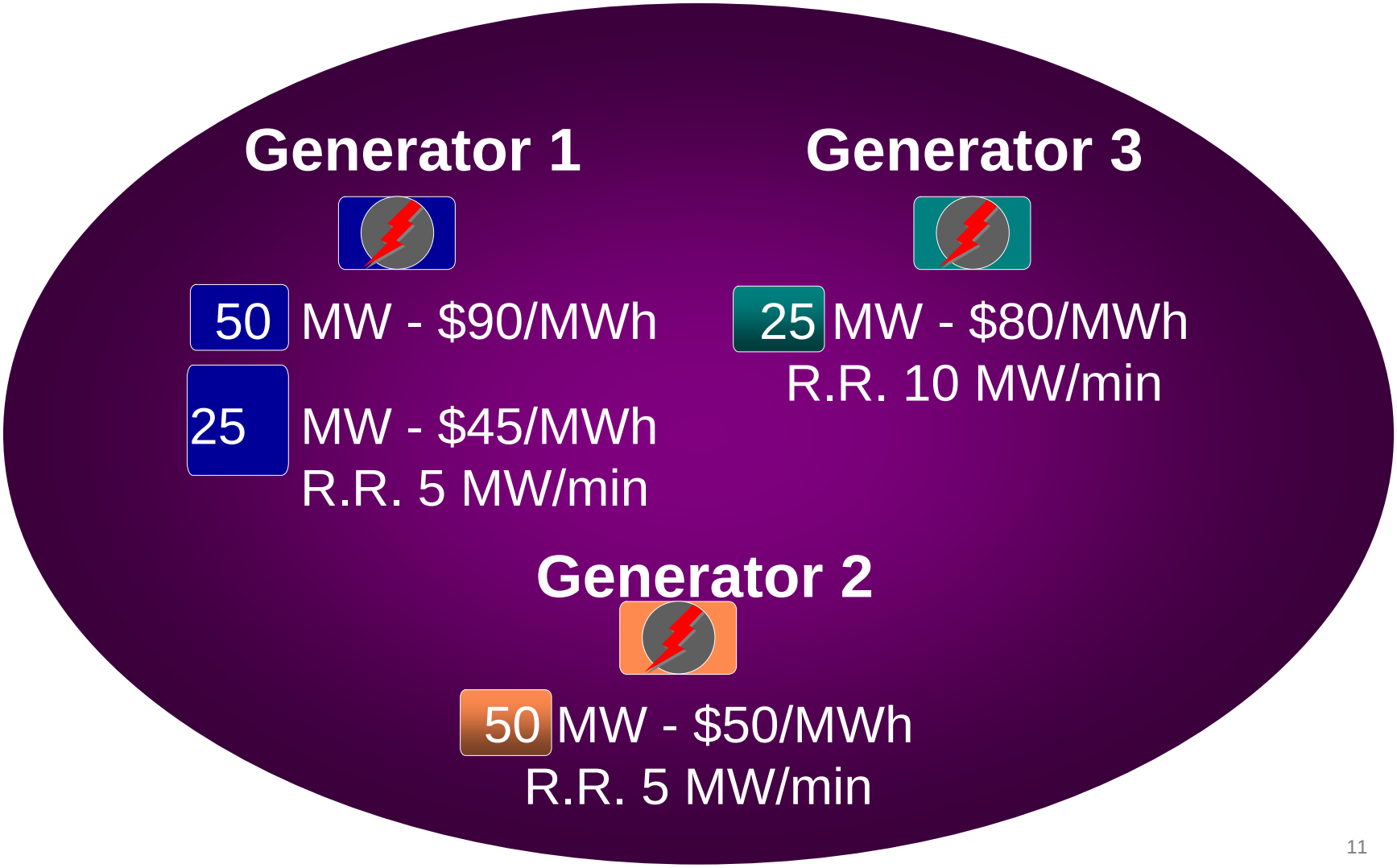
Ramp Rates, Schedules and Dispatch



Ramp Rates

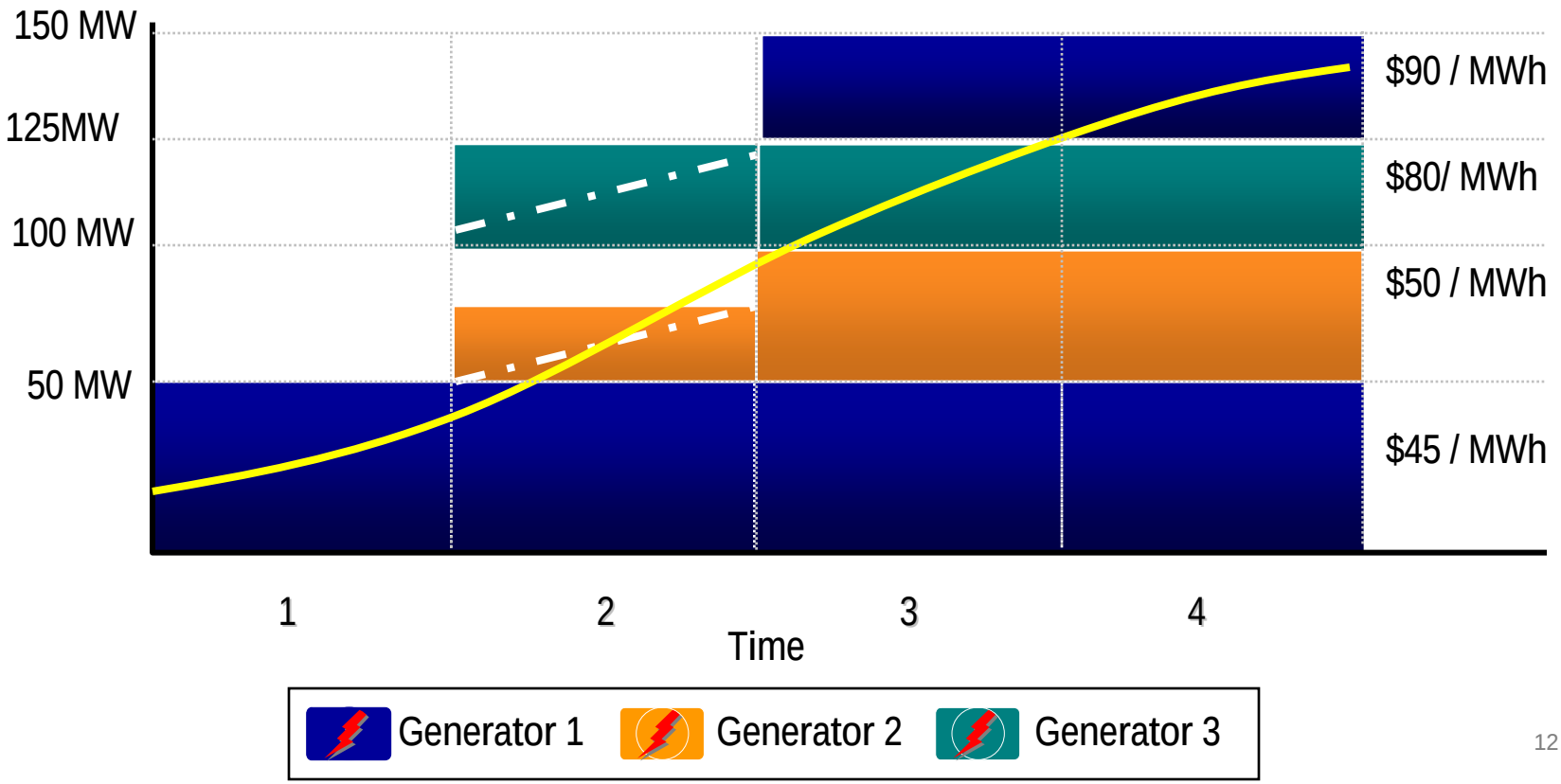
- Previously examined price-setting example assumed that the marginal unit could perfectly match the change in demand. This is not always true.
- Ramp rate refers to how quickly a facility can change its operating point
- Participants supply up to five ramp rates with their bid/offer
- e.g. a 120 MW generator may offer :
  (70,3,6),(120,4,8)
- Cannot dispatch beyond the ability of the generator to move

Setting the Market Clearing Price – With Ramp

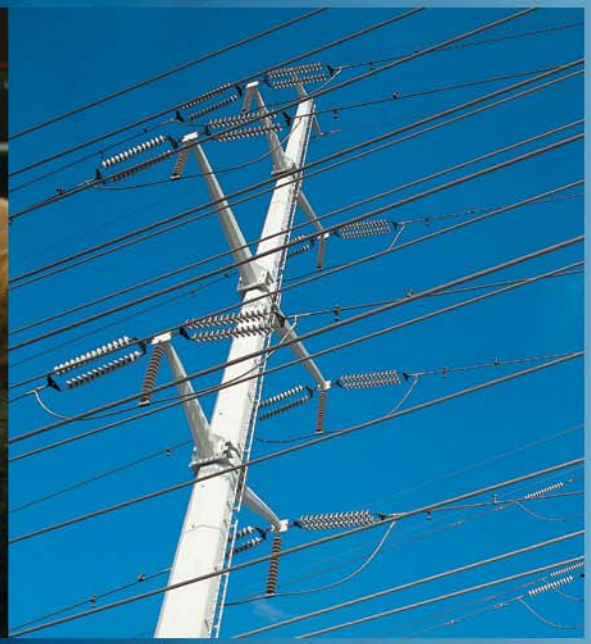


Dispatch Vs. Price

MCP $ / MWh	45	50	90	90
Dispatch Cost	45	80	90	90



One Times Pricing - Myopic

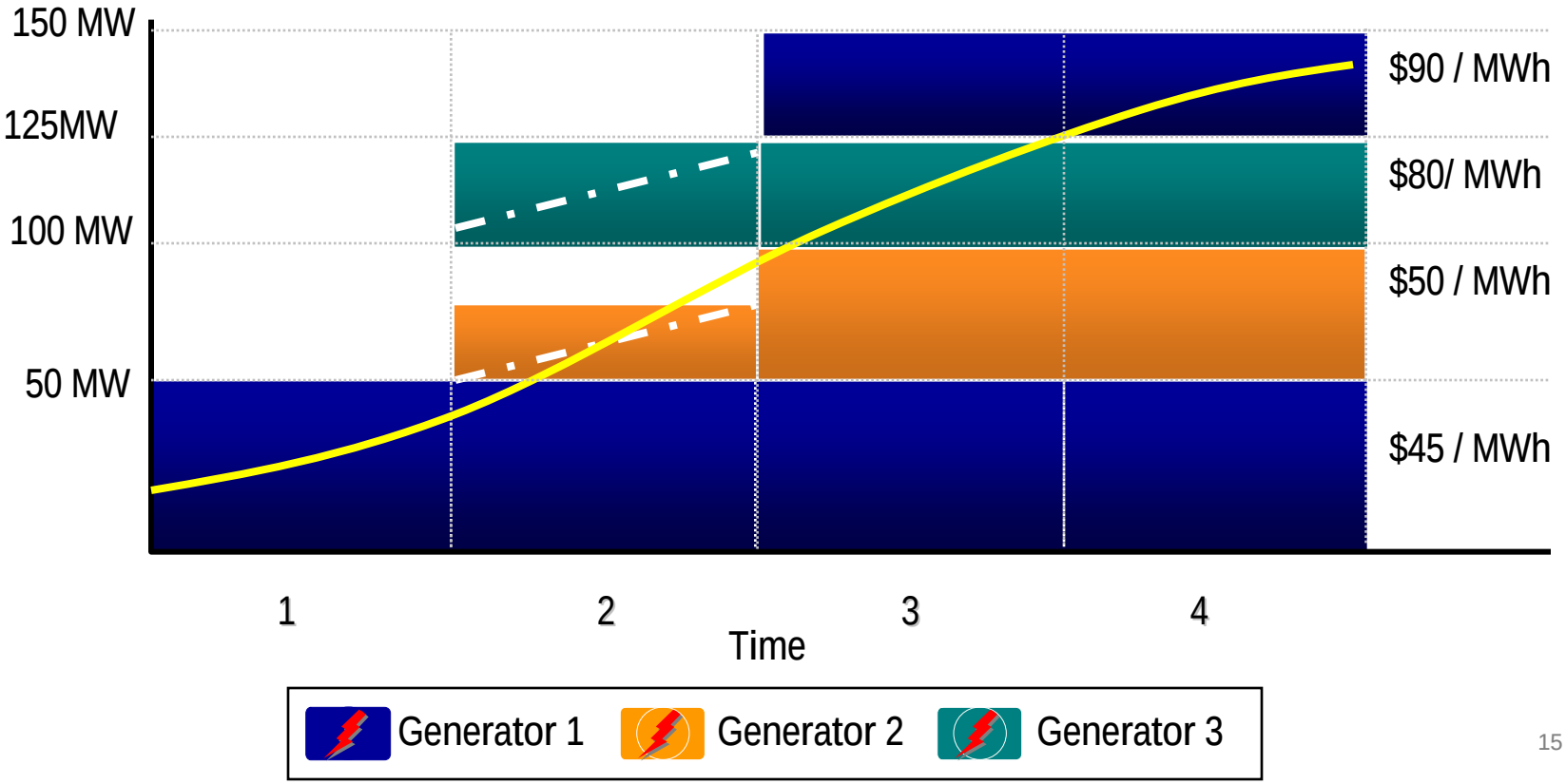


One Times Myopic

- Original market design did not use 12 times ramp rates
- Original design said the pricing algorithm should use actual ramp rates, allow the unit that can supply the next MW after demand is satisfied to set price

One Times Myopic

1X Myopic Price	45	80	90	90
Dispatch Cost	45	80	90	90



One Times Myopic

- No CMSC for ramp
- Price becomes more volatile as we have to move up the stack during periods of demand increase
- Design intent that generators will see the price spikes occurring and adjust their offers to ensure they are available to take advantage of the spikes
  - By making themselves available, more layers and ramp in the stack, so less price volatility occurs.

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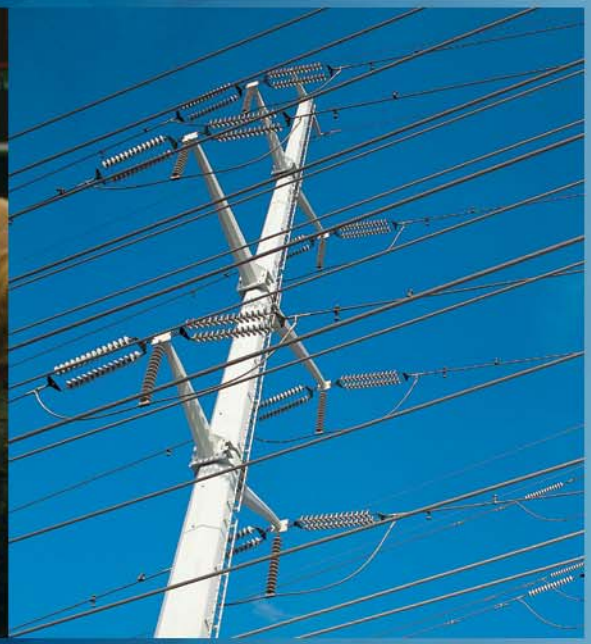
Twelve Times Pricing Decision Background



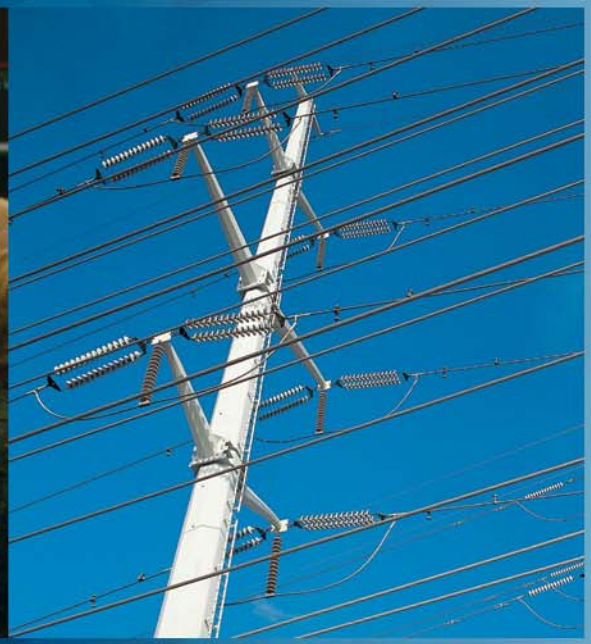
Twelve Times Pricing - Background

- Original market design was to use 1X myopic pricing (just discussed)
- Trials held just prior to market opening showed rapid and large price fluctuations (which would to some extent be expected)
- Suggestion to use 12X ramping as it meant the algorithm used 1 hour of generator ramp in each interval – effectively use the pre dispatch (planning) ramp each time we set price

Twelve Times Pricing - Background

- Twelve times approved as a temporary measure
  - Input on constrained pricing was coming in 18 months
- During Day Ahead Market design, IESO recommended constrained pricing – was not implemented
- Summer of 2004, MIO was introduced for dispatch, but not for pricing……

Multi Interval Optimization



Multi Interval Optimization

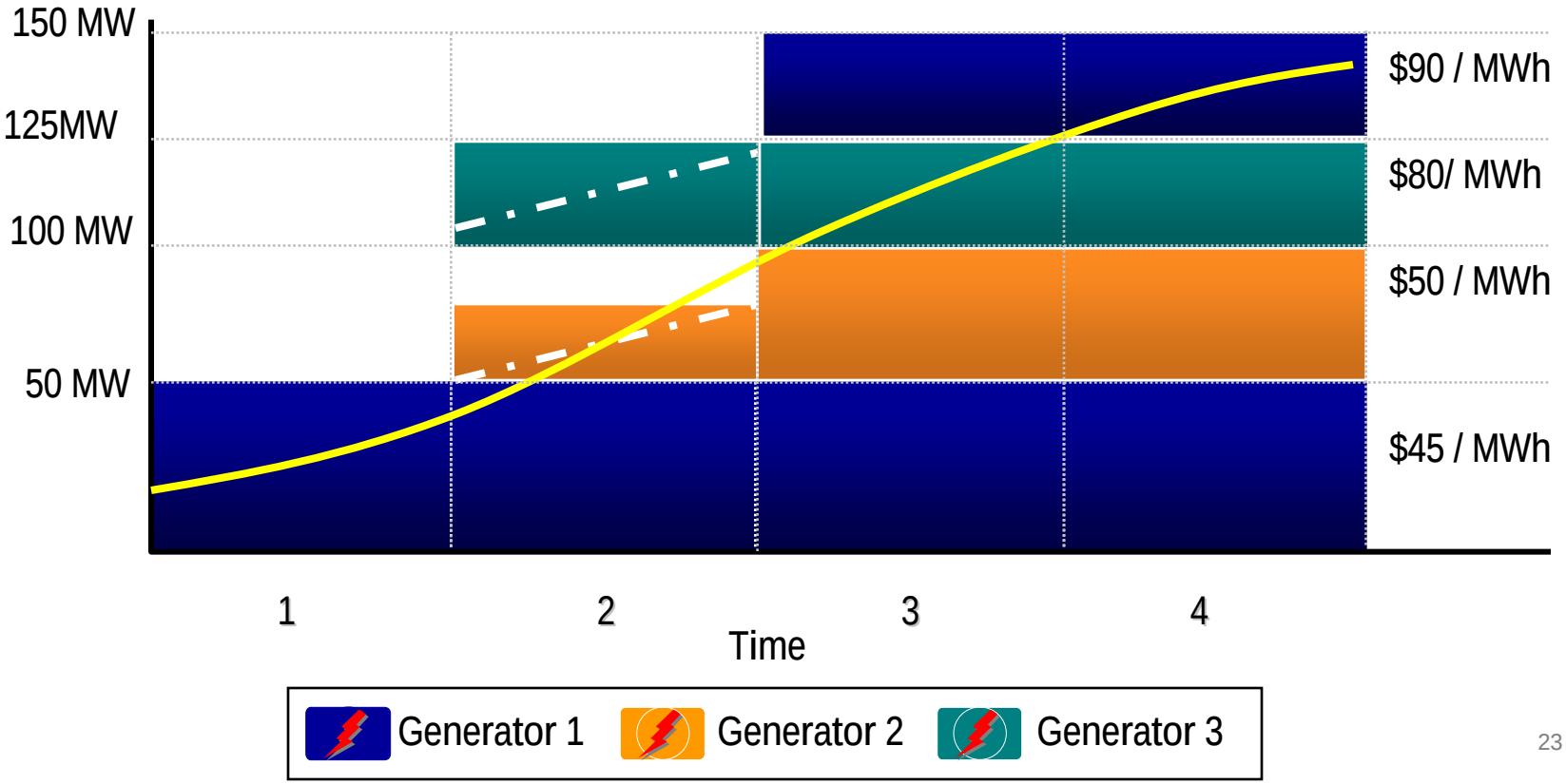
- We can plan ahead for known changes in demand – demand is predictable
- We always dispatched base on an estimate in the next five minutes, MIO optimizes over a longer period
- Determines the least cost solution considering multiple intervals

Multi-interval Optimization

- Available output in a given interval is influenced by what happened in the previous interval
- Result during increasing demand may be to pre load slower moving, more expensive generation in anticipation of increasing demand
- Cheaper generation will be dispatched lower to make up for pre loading

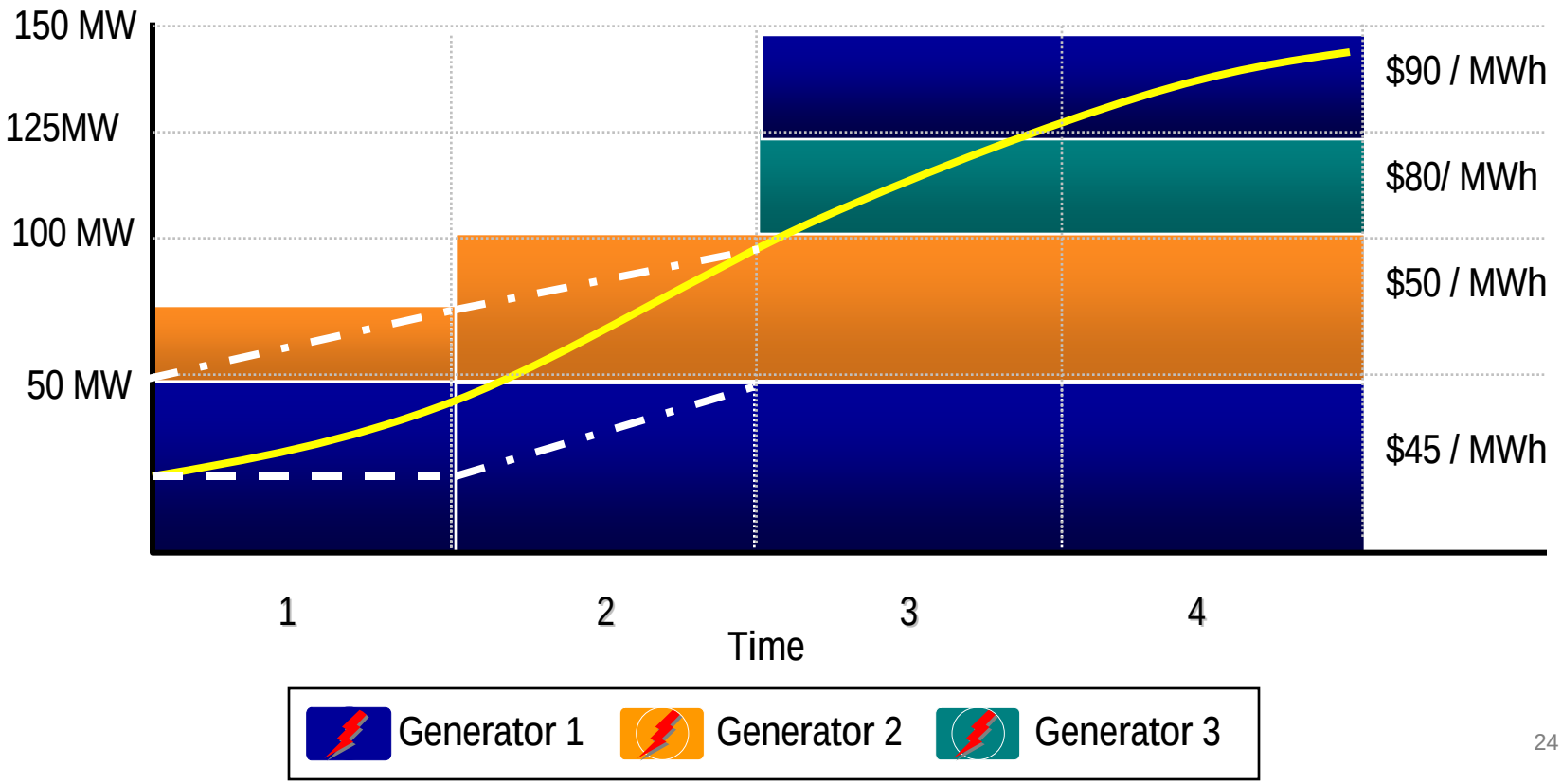
One Times Myopic

1X Myopic Price	45	80	90	90
Dispatch Cost	45	80	90	90



MIO

MCP $ / MWh	45	50	90	90
Dispatch Cost	50	50	90	90



MIO - Summary

- We currently dispatch using MIO but we do not set price using MIO
- It is possible to use the MIO process in the price setting algorithm
- MIO will optimize to find the lowest cost solution over several intervals
- MIO produces a less volatile price, without price "spikes" for routine demand changes (but will behave as 1X after contingencies)

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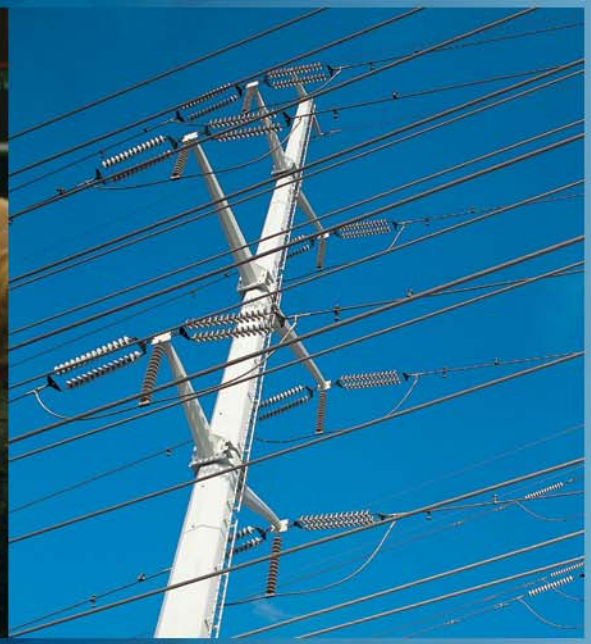
Other Options



Other Options

- So far discussed options related to price calculation
  - 12X, 1X Myopic, 1X MIO
- These all assume that generators build the cost associated with changing their output into their energy offer
- It is possible to pay for changing output separately from the energy price through a supplementary payment

AMPCO Suggestion

- AMPCO made a presentation that…
- Agreed that changing a generator output will add to the operating costs of the generator
- Acknowledges that the supply mix in Ontario must include generators with the ability to change their output in order to follow changes in demand
- Ramp is a product with different value at different times – when ramp is scarce, there should be a premium paid to generators that can provide ramp

AMPCO Suggestion

- AMPCO presented…..
- A ramp premium should not be paid to baseload generators that do not change their output in response to changes in demand
- An ancillary service payment be made only to generators that change their output when ramp is scarce
- Ramp is considered scarce when a 12X price is different than a ramp limited price such as a MIO price

AMPCO Suggestion

- AMPCO suggested two pricing runs, 12X and 1X (MIO)
- If the prices are different, ramp is short and so pay that difference per MW change in output to those generators who changed their output in response to IESO directions during the ramp shortage

APPrO Suggestion

- The Association of Power Producers of Ontario submitted that…
- 12X pricing is not working
- 12X is inefficient - ramping is a valuable service, and the current solution does not reward it
- Because the current methods do not impose any costs for ramping, the algorithm overuses it
- The IESO has estimated that in 2005 it sent requests for a total of 18.5 million MW of changed output to meet 8.9 million MW of demand change

APPrO Suggestion

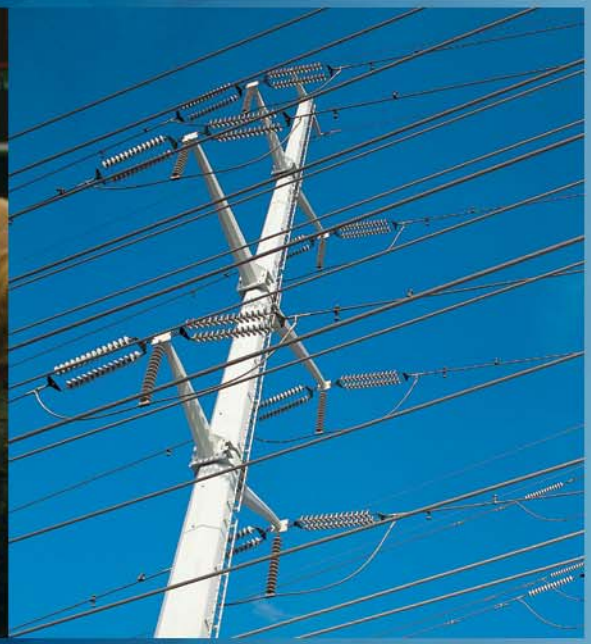
APPro Input (cont'd):

- Ramping does impose maintenance and emissions costs on generators
- It is difficult to build the cost of changing output into the energy offer, particularly for units that may move many times during an hour – sometimes in opposite directions

APPrO Suggestion

- APPrO has suggested that the best solution to the problem is to return to the original design of a 1X Myopic price setting process
- As an alternative, APPrO has suggested compensating for changing output with a supplementary payment
  - Any change in generator output requested by the IESO and delivered by the generator should be paid a fee per MW change
  - The fee would be a cost based number to be determined

Decision Criteria



Decision Criteria

Based upon the market design and Market Pricing Working Group guiding principles

1. Efficiency
2. Reliability
3. Robustness
4. Fairness
5. Transparency

Efficiency

We can talk about efficiency in terms of time frames. In the short term we can talk about Allocative Efficiency and over time we can talk about Dynamic Efficiency.

Efficiency

- *Allocative efficiency*: A condition achieved when resources are allocated in a way that allows the maximum possible NET BENEFIT from their use.
- Deals with getting the most efficient outcome with current resources

Allocative Efficiency

- Allocative Efficiency is reduced if energy is consumed by those who place a lower value on the energy than it cost to produce the energy.
  - Suppliers and consumers can see prices and are able to respond to them
- The algorithm is less likely to achieve allocative efficiency if participants do not bid/offer at their true marginal benefit/cost.

Dynamic Efficiency

- *Dynamic Efficiency* refers to efficient use of resources over time. An important aspect of dynamic efficiency is ensuring that investment, innovation and technology choice occurs optimally over time.
- If pricing methodology does not reflect system needs, it cannot signal the most efficient long term solution.

1X Myopic Pricing

- Supplier Community
  - Myopic pricing provides the correct signals for allocative and dynamic efficiency
  - Trading and strategic bidding will dampen any potential price increase

- Consumer Community
  - An increase in average prices is inappropriate because myopic pricing significantly overstates the value of energy
  - An increase in average prices rewards all forms of generation, peaking and baseload

Supplemental Payment for Ramp

- Generators believe IESO dispatch results in costs that can not be incorporated into their offer prices
- Generators have asserted that having the market pay for output changes will provide the added incentive to address erratic dispatch
- Some consumers have asserted that retaining a ramp neutral energy price and a supplemental payment for ramp delivered may be appropriate while retaining a ramp neutral price

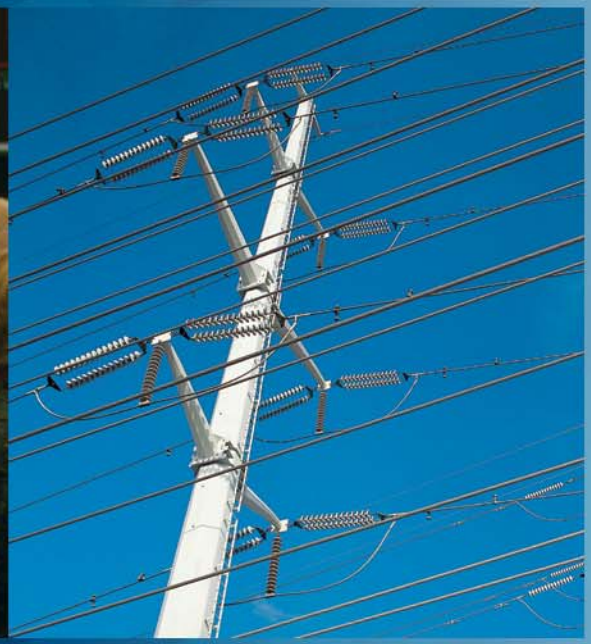
Multi Interval Optimization Pricing

- MIO is not well supported by the generator or consumer community
- Generators have experience with MIO only through dispatch and consumers have no experience with MIO
- Generators feel MIO pricing would reduce the transparency of an already opaque market
- Generators have stated that dispatch advisories from MIO are inaccurate, causing unease with basing prices on the same data
- Generators concerned that prices would become a function of IESO demand forecast since MIO depends on a forecast of upcoming demand

Status Quo

- Generators have claimed 12X removes price spikes they rely upon for revenue to maintain existing ramping capability and incentives to invest in additional capability, and that this revenue cannot be earned through existing market payments
- Consumers have indicated satisfaction with 12X pricing, but concern over reliability if generators are ramped excessively (causing wear and tear)

Summary



Summary

- 12X pricing was a temporary measure at market opening to deal with large, rapidly fluctuating prices
- Options include 1X myopic, 1X MIO and a supplementary payment
- Discussed at the Market Pricing Working Group, more information available on the website

http://www.theimo.com/imoweb/consult/mep_mp.asp